Intro to Truck Conversions (short)

followed by

Lighting Requirements when Converting a Truck Tractor to an RV Hauler

David Dixon

What is a Truck Conversion?



- Heavy-duty truck chassis with a motorhome body attached
- Heavy-duty type C
 motorhome

Why would I want a truck conversion?

Pros:

- Easier maintenance/repair than a conventional motorhome
- Access to living quarters while moving
- Much higher carrying capacities than most motorhomes
- Much higher towing capacities than most motorhomes
- Often more durable than most motorhomes
- Welded tubular steel box on some makes
- Generally easy to insure (similar to most motorhomes)
- You hear every jar as it falls out of the open refrigerator door.

Cons:

- Larger turning radius than many conventional motorhomes
- Less below-deck cargo space
- Noisier than a pusher chassis (but quieter than most type C motorhomes)
- Smaller windshield than most type A motorhomes

Who makes (or has made) truck conversions?

- Showhauler
- Renegade
- NRC
- Powerhouse
- Optima*
- United Specialties*
- Silver Crown
- Transport Designs
- Dynamax

• And probably quite a few others

Important Considerations

- Especially early on, many truck conversions were built on used trucks. A 2015 truck conversion could have a 10-year old truck under it.
- Many banks will make loans on truck conversions—IF the converter is NADA listed. Many have mileage limits (most either <100K or <200K miles).
- Box construction varies significantly—from laminated or FRP sidewalls to steel cages.
- Most of the used truck conversions for sale tend to be listed on racingjunk.com, under RVs/Motorhomes, with some in a special Class 8 Truck Conversion category.

Lighting Requirements when Converting a Truck Tractor to an RV Hauler

Overview

- General lighting and electrical principles
- Who regulates automotive lighting
- What lights/markings are needed and what purpose do they serve
- How to find "good" lights, and put the right light in the right place

Basic Lighting Principles

- For incandescant bulbs, brightness is roughly proportional to power, so getting full voltage to the lights is critical.
- Lights are tested at 12.8V—anything less and the light may not be as bright as required. $P = \frac{12.8 \text{V}}{R}$
- At 11.5V at the bulb, brightness is reduced 25%
- LEDs draw less current, so wiring voltage drop is reduced, but LEDs are more sensitive to voltage.
- Lights should be mounted facing the direction required—either directly to the rear or side, not at angles. Some lights have a "TOP" marking also specifying the direction the lamp should be oriented on the mounting surface.

Basic Lighting Principles

- The lighting standards are intended to make sure a consistent message regarding the size, orientation, and operation of a vehicle is presented
- Even though most drivers don't know the details of the standard, we all use lights required by it to discern what other vehicles are doing and how big they are (especially at night)
- Red should only be on or at the back, white should only be on front (except reverse lights).

Terminology

- Luminous Intensity candela (cd)
- Luminance lux or cd/m^2
- Luminous Flux lumens (lm) or cd-sr
- EPLLA Effective Projected Luminous Lens Area
- "As far apart as practicable"
- Separation distances

Who regulates automotive lighting?

- Automotive safety standards are part of the Code of Federal Regulations, 49 CFR 571, the Federal Motor Vehicle Safety Standards (FMVSS)
 - Canada's standards (CMVSS) are virtually identical; the rest of the world uses Economic Commission of Europe (ECE) standards.
- Within the standard, there are a couple of relevant sections regarding applicability:
 - A manufacturer, distributor, dealer, or motor vehicle repair business may not knowingly make inoperative any part of a device or element of design installed on or in a motor vehicle or motor vehicle equipment in compliance with an applicable motor vehicle safety standard prescribed under this chapter
 - When a motor vehicle safety standard is in effect under this chapter, a State or a political subdivision of a State may prescribe or continue in effect a standard applicable to the same aspect of performance of a motor vehicle or motor vehicle equipment only if the standard is identical to the standard prescribed under this chapter.
 - Compliance with a motor vehicle safety standard prescribed under this chapter does not exempt a person from liability at common law.
- FMVSS 108 addresses lighting and conspicuity markings.

Starting with a truck

- If you've bought a run-of-the-mill over-theroad truck, it likely already meets the requirements of a truck tractor
- It's not a vehicle designed to carry any cargo —only for towing trailers, and only rarely operated without a trailer
- It is required to meet all lighting requirements except:
 - Rear clearance and ID lights
 - Rear side reflex reflectors
 - Rear side marker lamps
- It is also required to have conspicuity tape 2 places:
 - Rear upper body marking (L-shape on back of cab)
 - Rear marking (strip across top of mud flaps)



What changes by adding a bed?

- It's no longer just a vehicle for pulling a trailer
- Practical places for mounting lights now exist
- It's much more likely to be driven without pulling a trailer (regardless of how you personally intend to use it)
- The truck may become longer, possibly exceeding 30' in length



What lights does my bed need?

On back:

- Tail lamps
- Brake lamps
- Stop lamps
- Turn signals
- Clearance lamps
- Identification lamps
- License plate lamp
- Reverse lamp(s)
- Rear reflex reflectors

On side:

- Rear side marker lamp
- Rear side reflex reflector
- Intermediate side
 marker lamp
- Intermediate side reflex
 reflector
- Intermediate turn signal

Tail (T), stop (S), and turn (I) lamps

Purpose:

- To signal the presence and width of a vehicle, and to indicate when it is braking, turning, or disabled.
- How many: 2 minimum
- Where: On the rear symmetrical - as far apart as practicable - facing rearward, 15-60" above the ground
- These lights should not be combined with any other functions.
- Turn signals should be mounted outboard of brake lights (if separate, which is recommended)

Reflex Reflectors (A)

Purpose:

 To signal the presence and size of a vehicle, particularly when parked or otherwise disabled



- How many: 2 rear, 2 rear side, 2 intermediate side
- Where:
- (2 red) On the rear symmetrical - as far apart as practicable - facing rearward, 15-60" above the ground
- (2 red) On the side at the rear, 15-60" above the ground
- (2 amber) On the side near center – roughly front of bed side for most

Side Marker Lamps

Purpose:

• To indicate presence and length



- How many: 2 rear, 2 intermediate
- Where: Each side at rear, and each side near center, as far back as practicable, at least 15" above ground
- Intermediate side markers can be repeated along vehicle's length. At least one for every 12-15 feet of length recommended.

Rear Clearance Lamps

Purpose:

• To show the width of a vehicle



- How many: 2 minimum
- Where: At widest point, on the rear or near the rear, symmetrical, facing rearward, as high as practicable. May be lower only if ID lamps are at top.
- May not be combined with tail lamps.
- Either top of rear side of bed, or top corners of sleeper/drom box

Rear Identification Lamps

Purpose:

• To indicate presence of a wide vehicle



- How many: Exactly 3
- Where: Rear center horizontally spaced 6-12 inches apart, facing rearward
 - US: As high as practicable
 - Canada: At the top
- May not be combined center brake light. No lights in between each of these lights.

Either top of rear side of bed, or top of sleeper/drom box

Backup and License Plate Lights

License Plate Light (L)

- How many: Minimum 1, white
- Where: On the rear, above or beside license plate. No mounting height or left-right position requirement.

Backup Light (R)

- How many: Minimum 1, white
- Where: On rear

Finding the Right Lights

- There are no *DOT Approved* lights. Anyone claiming this is either misinformed or lying. A light should, however, be certified by its manufacturer as DOT compliant.
- If it's labeled for off-road or show use only, it shouldn't be connected to any of your truck's lighting circuits. It's also illegal to sell a light for use on a vehicle that doesn't meet FMVSS 108 even if it's intended for off-road use.
- LEDs themselves are fairly reliable and made by only a handful of companies, but the reliability of the boards they're mounted on and the quality of the driver circuits varies quite a bit. Generally:
 - Stick to name brands
 - Look for the SAE type code, and make sure the light is designed for the function you need
 - Look for multiple resistors on the light's circuit board. Cheaper lights will use resistors to roughly control current through strings of (usually 3) diodes—this method doesn't sufficiently protect the diodes from higher voltages, and they're much more likely to dim if the voltage drops.

Recommendations

- Keep the primary functions (stop, tail, turn, and reverse) in the same general area
- Use amber turn signals where possible (5% reduction in rear crash rates)
- Add a center high mounted stop lamp (red) on vehicle centerline that activates with brake signal, 34" minimum above ground on vehicle centerline
- Leave (or install) conspicuity tape on back of sleeper and across top of mud flaps (truck tractor requirement)
- Be particularly attentive to mounting directions with LED lights
- Walk along side of and around truck looking for places where lights may be obscured. Think about where other drivers are likely to be (e.g. adjacent lanes).
- Don't be scared of the Volvo LCM!!

Pop Quiz!!

• Let's go through a couple of examples and see if we can identify all of the required lights.





